



The Tokyo Olympic Games and the Risk of COVID-19

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Abstract

Purpose of Review We reviewed the occurrence of outbreaks at past Olympics and discuss the threat of the COVID-19 pandemic at the Tokyo Games.

Recent Findings Evidence for large respiratory tract infection outbreaks at past Olympics is scant. Nevertheless, in order to control the spread of the COVID-19 outbreak, the Tokyo 2020 Olympics were postponed for 2021. Given the high contagiousness of the disease and the epidemiology of COVID-19 in Japan, this decision was appropriate and important in order to safeguard athletes and the public. However, it is a major problem for Japan, involving massive financial losses and a lost opportunity for athletes, coaches, and instructors.

Summary Up-to-date epidemiological data is needed on which to base an appropriate decision regarding the Tokyo 2021 Olympics. The actual effect of cancellations of such events in reducing the spread of COVID-19 needs to be determined.

Keywords COVID-19 · SARS-CoV-2 · Mass gatherings · Olympics · Paralympics · Athletes

Introduction

Mass gatherings (MGs) are defined as a “concentration of people at a specific location for a specific purpose over a set period of time which has the potential to strain the planning and response resources of the country or community” [1]. MGs can be spontaneous or programmed and irregular or recurrent [1]. Sporting, religious, and cultural events such as the Olympic Games, the Hajj, and music

festivals are programmed MGs [1]. MGs pose considerable public health challenges to health authorities and host governments, not only in regard to transmissible disease but also noncommunicable disease, such as trauma or injuries. In addition, illness related to the use of drugs and alcohol and environmental effects are well described as public health problems during certain types of MGs [1]. Infectious disease is one of the major challenges at MGs, as it affects the attendees during the event and can increase the load on the health system in the host country. In addition, infected participants may spread the disease on a large scale upon return to their home countries. In fact, several MGs have been identified as the source of infectious diseases that have spread globally [2]. Among the infectious diseases, respiratory tract infections (RTIs) are particularly frequent at MGs, due to the inevitable overcrowding and nature of its mode of transmission [2, 3, 4].

Recently, a novel coronavirus named SARS-CoV-2 emerged in Wuhan city, Hubei province, China, causing an outbreak of a respiratory infectious disease (COVID-19). The outbreak has spread rapidly and widely throughout the world. The World Health Organization (WHO) declared the event a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, and a pandemic on March 12, 2020 [5]. At the time of writing, the COVID-19 pandemic has accounted for 20,812,367 confirmed cases and 747,327 deaths in 213 countries and territories around the world [6].

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As part of efforts to control the spread of the COVID-19 pandemic, several important MGs events have been cancelled worldwide since early March 2020, including international and national sporting, religious, cultural, and other MGs. Many prominent sporting events with millions of participants have been cancelled or postponed, such as the Formula 1 Grand Prix in China, the Euro 2020 football championship, the Six Nations rugby championship in Italy and Ireland, the Mobile World Congress in Barcelona, and Olympic boxing qualifying events [7]. The 2020 Summer Olympics and Paralympics in Japan were originally scheduled to take place from July 24 to August 9, 2020, and from August 25 to September 6, 2020, respectively. Finally, it was halted in March 2020 because of the COVID-19 pandemic [8]. This international multisport event is now planned for July 23 to August 8, 2021 (Olympics), and August 24 to September 5, 2021 (Paralympics) in Tokyo, Japan. As with many other MGs events, the Tokyo 2020 Olympics would have been a significant opportunity for dispersing pathogens, especially SARS-CoV-2. We review the occurrence of infectious diseases at past Olympic Games, with a special focus on the threat of the COVID-19 pandemic at the Tokyo games.

An Overview of Infectious Diseases at the Olympic Games

Infectious diseases have been frequently reported in religious events like the Hajj, one of the largest religious MGs worldwide, and music festivals. But no strong evidence for a significant increase of infectious disease outbreak during sporting events has been identified [9]. Only a few RTI and gastrointestinal infection outbreaks were found in a review of Gautret et al., which included the Summer and Winter Olympics from 1984 through 2015 [9]. In the 2002 Winter Olympics in Salt Lake City, 36 cases of influenza among participants were recorded [10]. During the Vancouver 2010 Winter Olympics in Canada, an epidemic with 82 cases of measles occurred [11]. No major public health incidents occurred during the London 2012 Olympic Games. Only a few cases of RTIs and gastrointestinal illness were reported during this event, but no food-borne illness was directly linked to a Games venue [12]. During the London 2012 Olympics, a total of 47 sexually transmitted infections were diagnosed in 289 visitors, including 8 chlamydia and 15 nonspecific genital infections. There were no new cases of HIV or syphilis diagnosed [13]. During the Sochi 2014 Winter Olympics in Russia, 249 illnesses were reported among the 2788 athletes (the incidence was 8.9 illnesses per 100 athletes). Of those, 58% were caused by infectious diseases. RTIs were the most frequent (63.9%), followed by gastrointestinal symptoms (11%) [14].

The Rio de Janeiro 2016 Olympic Summer Games in Brazil included 11,274 athletes from 207 countries. During

this event, 613 illnesses were reported. Infectious diseases affected 56% of ill individuals. RTIs and gastrointestinal symptoms were the most common and occurred in 202 (47%) and 131 individuals (21%), respectively [15]. Although the Rio de Janeiro 2016 Olympics took place during the time of a Zika outbreak, no cases of Zika virus were detected among the athletes and attendees [16, 17].

In 2018, the Pyeong Ghang Winter Olympics in South Korea had the highest number of athletes (2920) and participating countries (92) in the history of the Winter Olympics [18•]. During this event, the most common cause of illness was RTIs [18•, 19•]. A total of 1639 athletes consulted polyclinics, including 1402 (85.5%) visits for illness, with 107 cases of upper RTIs. Common cold was also observed in 42 of 112 members of the Finland team [20]. The etiology of the RTIs was detected in 30 of 42 patients by multiplex-PCR, with 9 different respiratory viruses identified. Human coronavirus (HCoV) 229E (11 cases) was the most frequent, followed by HCoV NL63, influenza B, human rhinovirus, respiratory syncytial virus type A, and metapneumovirus (5 cases). The survey showed that the viral infections spread easily within the same sport discipline or the team. In addition, co-infections were also common [20]. Also, during the Pyeong Ghang 2018 Winter Olympics, a norovirus outbreak emerged a few days before the event began. This outbreak affected 172 volunteers staying at hostels but only 4 athletes [18•].

Large RTI outbreaks were rarely reported at previous Olympic Games. This can be explained by the fact that the participants move to other locations at the end of an event and do not live on site, contrary to large religious MGs. Furthermore, the duration of each sport event is short (less than 1 day) [9–17, 18•].

Olympic Game Massive Gatherings and Risk Assessment for Dissemination of COVID-19

Unlike the case of Zika virus during the 2016 Summer Olympics in Rio de Janeiro, the SARS-CoV-2 virus is transmitted by the respiratory route and can be easily transmitted between humans. The reproduction number R (R_0) of SARS-CoV-2 is estimated up to 4.1 [21–23]. In comparison with the SARS-CoV and influenza virus, SARS-CoV-2 is more transmissible [24•]. In addition, the strong infectivity of SARS-CoV-2 and rapid transmission even from asymptomatic carriers during the long incubation period have been previously described [25]. Because the incubation period of the virus is long (up to 14 days) [26], controlling viral dispersion seems to be difficult. The Tokyo Olympic Games were supposed to receive 20 million non-residents visitors from 204 countries and regions [27•, 28], and the stadiums would have been overcrowded. The relatively close contact between participants, including athletes and staff, spectators, and journalists,

could increase the spread of COVID-19. Moreover, there was a high risk of globalization of virus transmission by travellers. Screening at airports is feeble, and nearly 46% of infected travellers cannot be identified [29]. Body temperature is ineffective for screening SARS-CoV-2 among young adult travellers; only 18% of COVID-19 cases present a fever of 38 °C [30].

Currently, the risk of a rebound of COVID-19 in the near future is worrisome in several countries [21], including Japan. Figure 1 shows the two waves of COVID-19 in Japan. The number of new daily cases in the second wave tends to be higher than the first wave. COVID-19 new daily cases varied from 853 to 1998 during the planned periods of the Tokyo 2020 Olympics (from July 24 to August 9, 2020) (Fig. 1) [6].

Regarding athletes, they are viewed as being fit and healthy, but this might not be accurate [31]. The overtraining syndrome and high glycemic diet are often associated with chronic diseases. Those with chronic diseases are more susceptible to SARS-CoV-2 infection and aggravation or complications of COVID-19 [5]. Athletes are exposed to a higher risk of infection because of their compromised immune system [31–33]. Pedersen et al. conducted a study on the relationship between immune depression and infection among athletes [34]. After exercise, athletes have a transitory “open window” effect of immune depression lasting 3 to 72 h. This period makes the host more susceptible to infection from several microorganisms and potentially increases the risk for SARS-CoV-2 infection [35••].

Paralympics athletes are exposed to more risks for infectious disease, including RTIs [35••]. During the Rio 2016 Paralympics season, athlete delegations were approximately 60% physical-motor deficient, 25% visually impaired, and 5% intellectually disabled [35••]. They presented twice the amount of total illness in comparison to the Olympic athletes, and RTIs were the most frequent. Controlling disease in Paralympic athletes is relatively more complex. It is estimated that between 10 and 20% of these athletes are at risk of aggravating symptoms if they are infected by COVID-19 [35••].

Impact of the Cancellation of the Tokyo 2020 Olympic Games

In order to take measures to contain the spread of the COVID-19 pandemic, several national and international MGs, including sporting events, have been cancelled or postponed worldwide since early March 2020 [7]. The question of stopping the Tokyo 2020 Olympic was raised early [8]. On April 28, 2020, the President of the International Olympic Committee confirmed that the 2020 Olympic Games should be cancelled and postponed until 2021 [36]. The name of the event will remain unchanged: “Tokyo 2020 Olympic and Paralympic Games.” In the past, several Olympic Games have been cancelled by world wars, including the 1940 Tokyo Summer Olympics due to the onset of World War II [36]. Some Olympic Games have been held successfully despite global

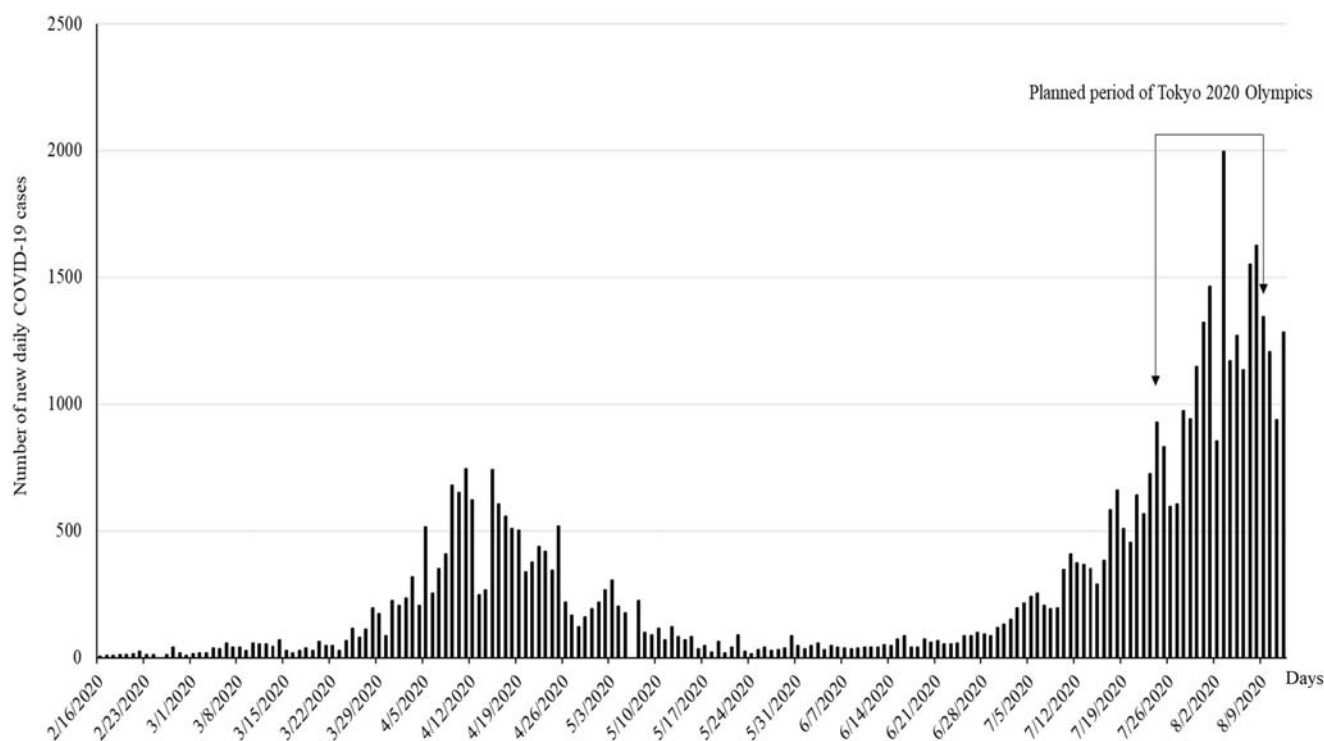


Fig. 1 COVID-19 pandemic in Japan [6]

health crises, such as the Vancouver 2010 Winter Olympics during the H1N1 influenza pandemic and the Rio 2016 Olympics during the outbreak of Zika virus. This is the first time in the 124-year history of the modern Olympic Games that they have been postponed due to a medical issue.

The decision to postpone the Tokyo 2020 Olympic and Paralympic Games to 2021 was appropriate and important in order to safeguard the athletes as well as the public [37]. However, it is a major problem not only for the host country in terms of massive financial losses but also for the 11,000 Olympic and 4400 Paralympic athletes who were due to take part in this important sporting event mostly because of loss of opportunity [38••].

The cancelling of this event cost Japan 4.52 trillion yen (41.5 billion USD), based on operating expenses, considering maintenance expenditures for the unused facilities and loss of tourism activity.

Athletes have been directly affected by the decision to postpone the Tokyo 2020 Olympics due to the COVID-19 pandemic. The postponement of the 2020 Olympics automatically meant retirement and the permanent loss of opportunity for some [38••, 39]. Athletes have lost daily, weekly, monthly, and yearly workout routines, which affects their mental and physical state [38••]. The spread of COVID-19 forced nearly every training site to close and forced players to stay home. Social distancing measures have affected not only the Tokyo Olympic and Paralympic games but all other sporting events, including the cancellation of qualifying tournaments. These changes have increased feelings of uncertainty, confusion, and frustration and made it difficult to establish a specific set of goals [38••, 39, 40]. In addition, because of the limited opportunity to leave the house for systematic and intensive training, when players are allowed to train for shorter periods of time, they tend to overwork to maximize impact and that may increase the likelihood of injury. Limiting interactions with teammates, coaches, and others can also make athletes more anxious [38••, 40].

Coaches and instructors were another group affected by the COVID-19 outbreak. They had particular difficulty in coaching athletes. Also, they may not have been able to allocate enough energy and time to focus on the athlete's conditions, because they needed to care for themselves and their families [38••].

Mandatory doping tests were severely limited by the COVID-19 outbreak in early 2020. European anti-doping organizations raised concerns that urine and blood tests could not be performed. Mobilizing the staff necessary to do so before the end of the pandemic may increase health risks. The World Anti-Doping Agency stated that public health and safety was their topmost priority despite the need for extensive testing [36]. Due to the COVID-19 outbreak, the Chinese anti-doping agency temporarily ceased testing in early February 2020. Also, the USA, Great Britain, France, and

Table 1 WHO recommendations to sport event organizers in the context of COVID-19 [43]

WHO recommendations to sport event organizers in the context of COVID-19

Pre- and during event

- ✓ Ensure availability of handwashing and hygiene facilities at multiple locations in the event
- ✓ Ensure good hygiene signage across all venues
- ✓ Provide first aid and medical services
- ✓ Temperatures should be checked each day and any fever case announced to the event medical staff
- ✓ Ill travellers should be managed at points of entry
- ✓ Ensure capacity to isolate suspected cases
- ✓ Develop and make available risk communication on clinical features of COVID-19 and preventive measures, including hand hygiene practices, physical distancing, practical implications of quarantine and criteria for asking individuals with symptoms
- ✓ Ensure availability of rubber gloves to team staff and volunteers handling laundry, towels, etc.
- ✓ Recommend that towels are for single use only
- ✓ Provide each participant with a clean water bottle
- ✓ Make handkerchiefs and containers to dispose used tissues with lids available on all buses
- ✓ Provide each team with a facility for athletes' temperatures check
- ✓ Determine the areas to care for and isolate the infected individuals
- ✓ Determine the areas to quarantine the persons in contact with confirmed cases
- ✓ Determine the areas for training the athletes and team staff if a COVID-19 case is notified
- ✓ Prepare a place where to receive a large number of quarantined persons
- ✓ Predetermine emergency contacts with local health authorities
- ✓ Medical masks should be ready, particularly for medical staff and sick individuals
- ✓ Provide disinfectant wipes to disinfect touched surfaces in all areas
- ✓ Consider provision of individual prevention packages for athletes containing thermometer, medical mask, hand sanitizer, disposable tissues, and disposable plastic drinking cups

Pre-event

- ✓ Proactively and regularly check the health status of anyone participating
- ✓ Avoid participating in the event if an individual is feeling ill
- ✓ The team leader should ensure that their teams and volunteers are briefed on the protocols for a suspected and confirmed patient

During event

- ✓ Participants should be aware of and cooperate with team medical staff at venues in checking their temperatures each day. Any fever above 38 °C need to be reported to the event medical lead
 - ✓ Wash hands often with soap and water or hand hygiene with alcohol-based sanitizer
 - ✓ Hand sanitizer stations should be available throughout the event venue
 - ✓ Practice respiratory etiquette, cover coughs and sneezes with disposable tissues, isolate and seek medical advice if coughing persist.
 - ✓ Avoid contact with sick persons
 - ✓ Avoid contact with anyone if you are ill
 - ✓ Use of gloves when handling towels or laundry in the team environment
 - ✓ Towels should not be shared
 - ✓ Athletes should not share clothing, bar soap, or other personal items
 - ✓ Water bottles should be labelled and washed with dishwasher soap after each practice or game, and officials and staff should have their own water bottles to prevent the transmission of viruses and bacteria
 - ✓ Advise athletes not to touch their own mouths or nose
 - ✓ Avoid shaking hands or hugging
 - ✓ Avoid steam rooms or saunas
 - ✓ Be aware of regular cleaning of frequently touched surfaces
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Germany anti-doping organizations had reduced their testing activities by the end of March 2020 [36]. That can significantly increase doubts about fair play in the Olympic Games.

Tokyo 2021 Summer Olympics, What Needs to Be Prepared in the Current State?

The President of the Japan Medical Association has been quoted as saying that the Tokyo Olympic Games can only be organized next year if an effective vaccine against COVID-19 is developed for public use and the pandemic is fully controlled, not only in Japan but worldwide. Regarding the current COVID-19 pandemic, it is certainly too early to predict whether the Tokyo Olympic Games will occur in 2021 or will once again be cancelled. SARS-CoV-2 surveillance should be maintained for a long time after the elimination of the initial pandemic [41]. However, this is an important sporting event in the world that only happens once every 4 years, so everyone hopes that it will take place as planned.

During this event, the movement of participants across frontiers and within the host country would most certainly intensify the spread of COVID-19 from one country to another, since travel is clearly one of the key contributors to disease globalization.

To date, there is no specific evidence available for planning and implementing a MG during the COVID-19 pandemic nor is there evidence for the effectiveness of individual mitigation actions for COVID-19 [42]. In collaboration with global partners involved in MGs health, the WHO made recommendations for sports event organizers regarding planning for MGs in the context of COVID-19 (Table 1) [43]. By complying with the existing WHO guidelines, governments can impose limits and minimize the spread of SARS-CoV-2 [44].

Detection and monitoring of MG-related COVID-19 cases should be carefully considered in the context of surveillance schemes, and enhanced surveillance is necessary. In collaboration with local health authorities, organizers should agree in advance about the circumstances in which risk mitigation measures would need to be reinforced. The host country must be prepared to provide adequate prevention measures and diagnostic capabilities. However, during the Games, there are about 14 million food dishes expected to be delivered to participants [37]. This represents a huge challenge for organizers, particularly as regards health security. And the control of COVID-19 will add to this burden.

Conclusion

Up-to-date epidemiological data is needed on which to base an appropriate decision regarding the Tokyo 2021 Olympic and Paralympic Games. If the pandemic continues and is

uncontrolled, not only in Japan, but worldwide, or if there is no effective vaccine developed for public use, these events may remain cancelled. The cancellations have social and economic impacts on individual livelihoods, public morale, and on national economies. The effect of cancellations of these events on reducing the spread of COVID-19 needs to be determined. If a decision is made to proceed with the Olympic Games, risk mitigation measures must be put in place, consistent with WHO guidelines on social distancing for COVID-19. The rationale for the decision should be also clearly explained and communicated to the public.

Compliance with Ethical Standards

Conflict of Interest Van Thuan Hoang, Jaffar A. Al-Tawfiq, and Philippe Gautret declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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